Adding biology to the PTM

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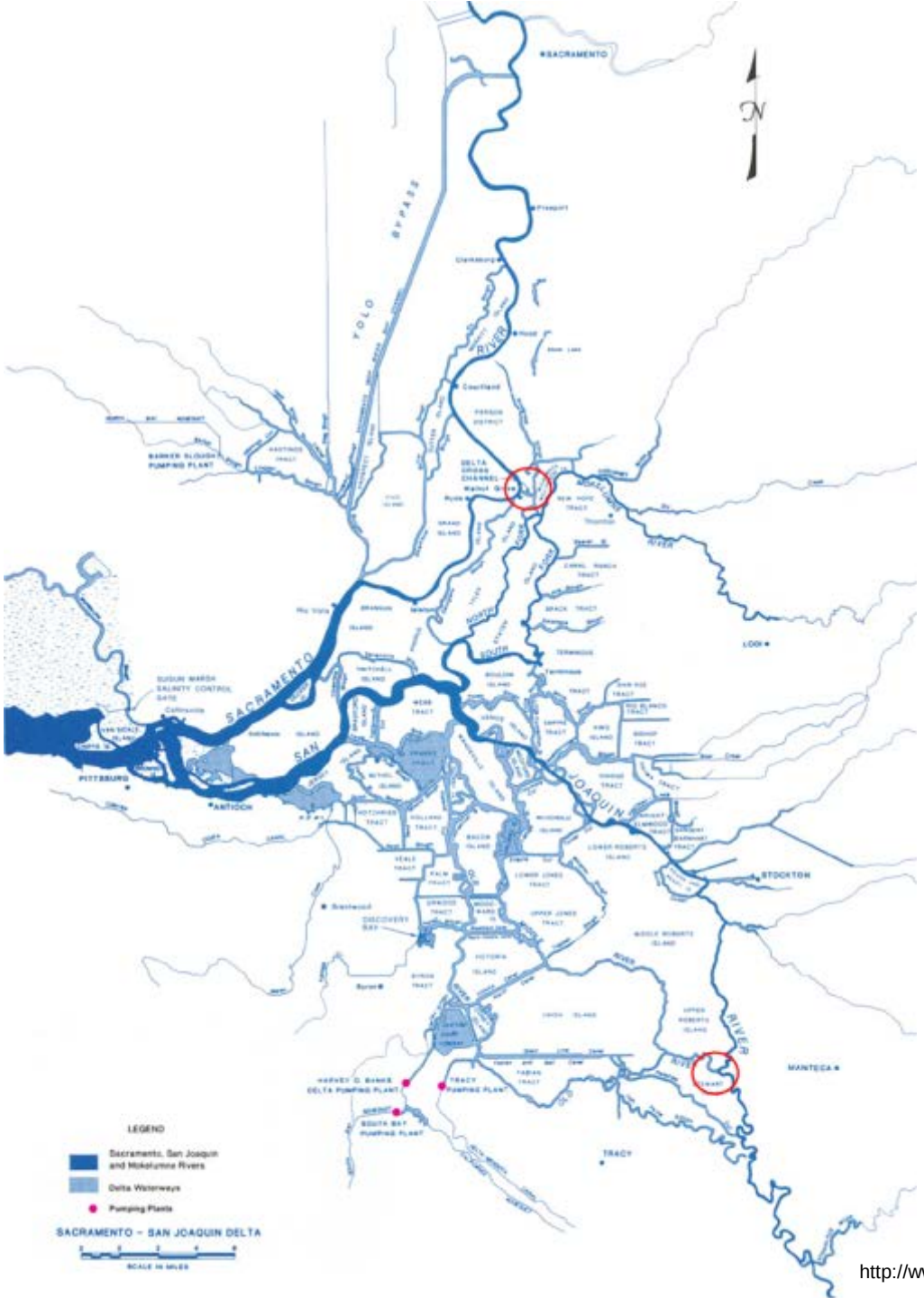


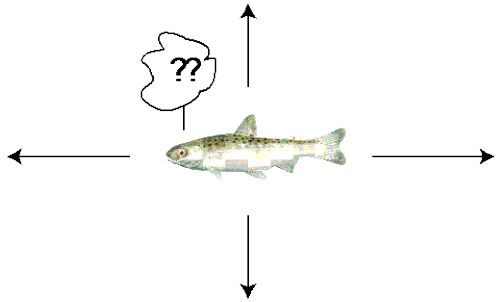
http://www.eenews.net/assets/2010/08/02/map_gw_01A.jpg

Day/Night

Tidal Phase

Salinity gradient

Velocity

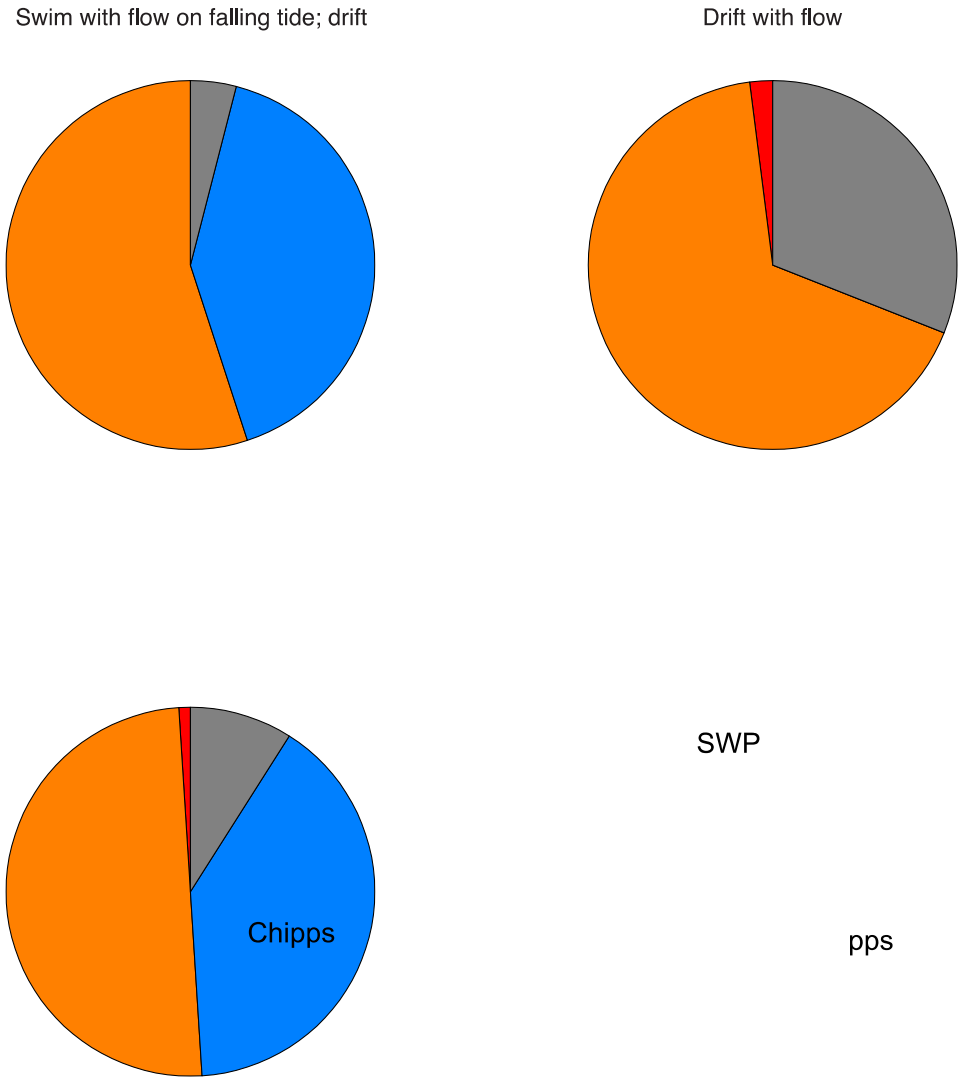


swim, drift, hold position

Behavior models

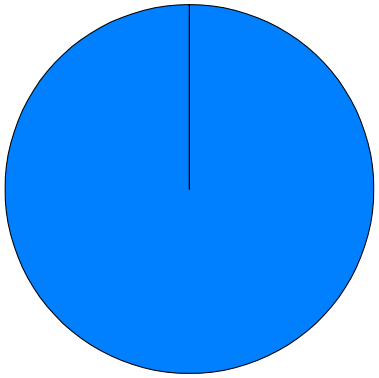
Cue	Response
None	Drift
Channel direction	Swim towards ocean
Tide phase	Swim with flow on falling tide; hold or drift on rising tide
Flow	Swim with flow; swim with flow when positive and drift or hold when negative
Salinity	Swim towards salt when in brackish water

San Joaquin R release (1 June 2002)

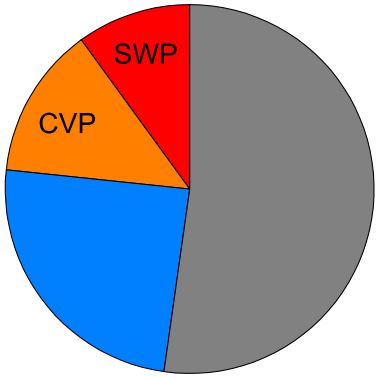


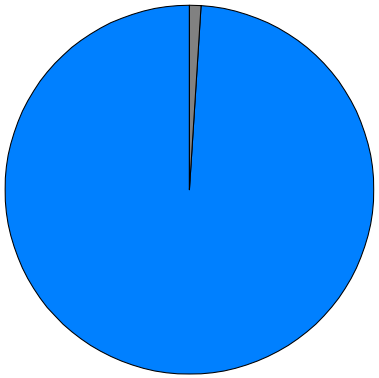
Sacramento R release (1 June 2002)

Swim with flow on falling tide; drift



Drift with flow





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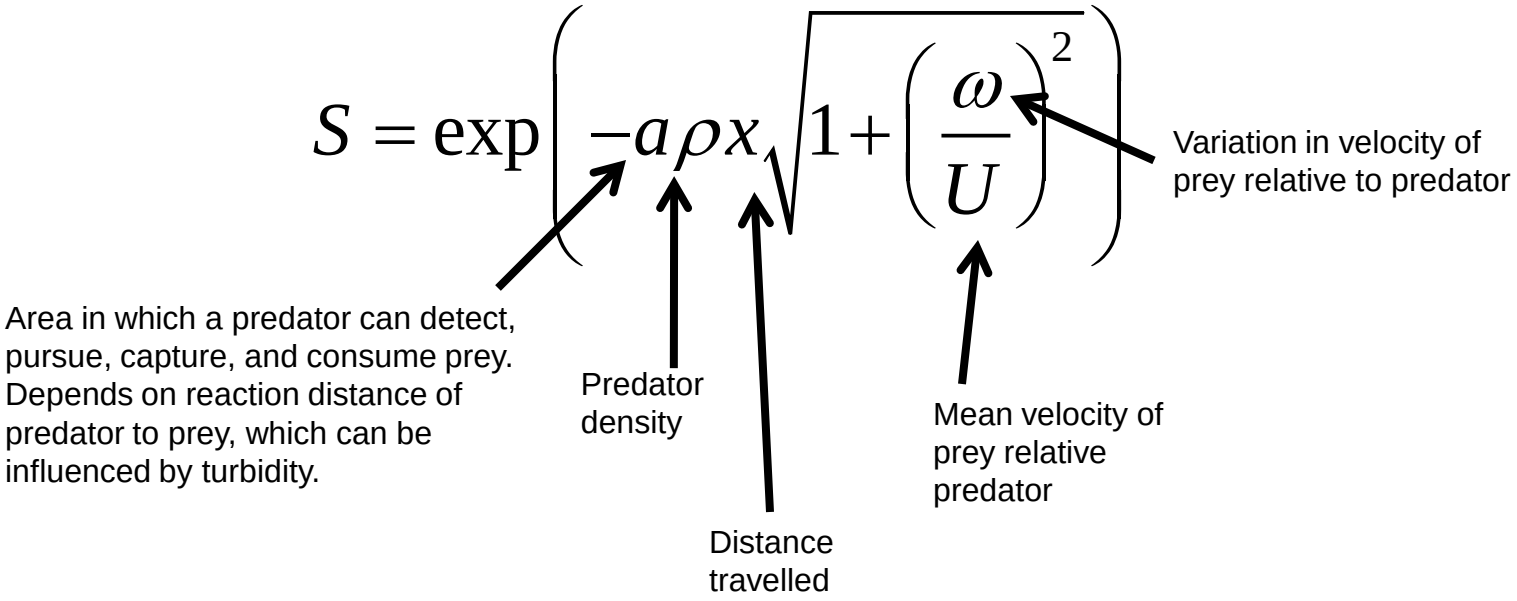
The XT Model



Special cases of XT model:
Gauntlet model: depends only on distance ($U >> \omega$)
Exposure time model: depends only on time ($\omega >> U$)

Anderson et al. Ecol Mod 186:196 (2005)

The Gauntlet model:

$$S = \exp\left(-rx\right)$$

The exposure time model:

$$S = \exp\left(-r\omega t\right)$$

The constant-ω exposure time model:

$$S = \exp\left(-rt\right)$$

where
r is mortality rate
x is distance traveled
t is travel time

Model Comparison

Model	NLL	AIC	ΔAIC	R^2
XT model	28.5	61.1	26.0	0.576
Gauntlet model	25.2	54.4	29.3	0.621
Exposure time model	30.8	65.6	30.5	0.543
Constant-ω exposure time	15.5	35.1	0	0.726

When reach is added to best model:

Best model + reach	**7.5**	**32.9**		**0.790**

Comparison Among Reaches